

# Unit-1 Introduction to Computer Organization

## 1.1 What is a computer?

Computer is an electronic device, which can automatically accept and store input data, process them, and produce output results according to the instruction given by the user or programmer.

## 1.2 Characteristics of Computers.

A computer can be characterized by the following points:-

- Speed

It is a very fast device. It performs the task in few milliseconds for which a normal human being may take years to complete. Speed of computer is measured in terms of milliseconds ( $10^{-3}$ ), microseconds ( $10^{-6}$ ), nanoseconds ( $10^{-9}$ ), or picoseconds ( $10^{-12}$ ).

- Accuracy

Accuracy of computer is very high. In most cases errors are due to human factors rather than technological factors. For example, error caused due to improper thinking of programmer, or incorrect input data, often called as CIGO (Garbage in Garbage out).

## • Diligence

Computer is free from monotony, tiredness and lack of concentration. It never gets bored. If 10 million calculations have to be performed, a computer will perform the 10 million calculations with same accuracy as 1<sup>st</sup> once.

## • Versatility

Computers are capable to perform almost any task, if the task can be reduced to a series of logical steps. The same computer can be used for multiple tasks. For example, you can prepare your bio-data in word, simultaneously you may be printing a report or surfing the internet, etc.

## • Power of remembering (Storage Capacity)

Computer can store and retrieve any amount of information because of its secondary storage. The information is retained accurately as long as desired by the user.

## • No IQ

It has no intelligence. It has to be told what to do and in which sequence. Computer can not take decision on its own.



- No ~~feeling~~ feeling

Computers have no natural feelings since they are machines. Their feelings are based on the instructions given to them in the form of programs written by us.

## History of Development

### Evolution of computer

- Word Length

No. of bits executed in one cycle is called its word length. i.e. computer having higher word length works faster.

## History of Development

### Evaluation of Computer

(i) ABACUS :-

- The earliest device that qualifies as a digital computer is abacus.
- It is also known as 'SOROBAN'.
- ~~(i)~~ Numbers are represented by position of beads on wire.
- Simple addition and subtraction was possible using abacus.
- It's upper part contain 2 beads and lower part contain 5 beads per wire.

(ii) MARK - I [1937 - 1944] :-

- It is first fully automatic calculating machine.
- It was 50 feet long and 8 feet ~~long~~ high.

(iii) ABC ( ~~ANTANSOFF~~ ~~ATANS~~ BERRY COMPUTERS) [1939 - 1942] :-

- It is developed by Dr. John ~~Antansoff~~ <sup>Atansoff</sup> and his assistance ~~Cliff~~ Clifford Berry



→ It was electronic machine to solve ~~now~~ mathematical equation.

→ It used 45 vacuum tubes for internal logic and 100 capacitors for storage.

#### (iv) ENIAC [1943 - 46] :-

→ Electronic Numerical Integrator And Calculator.

→ It was first electronic computer.

→ Developed for military need.

→ It took the space in 20 x 40 square feet room.

→ They used 1800 vacuum tubes.

→ In ENIAC computer program were wired on board which were difficult to change.

#### (v) EDVAC [1946 - 52]

→ Electronic Discrete Variable Automatic Computer.

→ It was designed on stored program concept. (~~Sequence~~ Sequence of instruction and Data stored in memory)

→ Von Neumann has introduced the concept of storing both instruction and data in binary form.

(vi) EDSAC [1947 - 1949]

→ Electronic delay storage automatic calculator

→ Britishers develop EDSAC

(vii) UNIVAC - I [1951]

→ Universal Automatic Computer

→ First Digital Computer

→ In 1954 International Business Machine (IBM) introduced improved model of UNIVAC - I



## Applications of Computers

Computers play a role in every field of life. They are used in homes, business, educational institutions, research organization, medical field, government offices, entertainment etc.

### → Home :-

- Computers are used at homes for several purposes like online bill payment, watching movies or shows at home, home tutoring, social media access, playing games, internet access, etc.
- They provide communication through mail.
- They help to ~~avail~~ work from home facility for corporate employees.
- Computers help the student community to avail online educational support.

### → Medical Field :-

- Computers are used in hospitals to maintain a database of ~~the~~ patient's history, diagnosis, X-rays, monitoring of patients etc.
- Surgeons nowadays use robotic surgical devices to perform delicate operations, and

conduct surgeries remotely.

- Virtual reality technologies are also used for training purposes.

→ Entertainment :-

- Computers help to watch movies online, play games online, act as a virtual entertainer in playing games, listening to music etc.
- Videos can be fed from computers to full screen television.
- Photo editors are available with fabulous features.

→ Industry :-

- Computers are used to perform several tasks in industries like managing inventory, designing purpose, creating virtual samples, video conferencing, etc.
- Online marketing has seen a great revolution in its ability to sell various products to inaccessible corners like interior or rural areas.
- Stock market have seen phenomenal participation from diff. levels of people through the use of computers.



## → Education :-

- Computers are used in education sector through online class, online exam, referring e-books, online-tutoring, etc.
- They help in increased use of audio-visual aids in the education field

## → Government :-

- In government sectors, computers are used in data processing, maintaining a database of citizens and supporting a paperless environment.
- The country's defence organization have greatly benefited from computers in their use for missile development, satellites, rocket launches, etc.

## → Banking :-

- In the banking sector, computers are used to store details of customers and conduct transactions such as withdrawal and deposit of money through ATMs.
- ~~Bank~~ Banks have reduced manual errors and expenses to a great extent through extensive use of computers.

## → Business :-

- Nowadays, computers are totally integrated into business.
- The main objective of business is transaction processing which involves transactions with suppliers, employees or customers.
- Computers can make these transactions easy & accurate.
- People can analyse investment, sale, expense, market and other aspects of business using computers.

## → Training :-

- Many organizations use computer-based training to train their employees, to save money & improve performance.
- Video conferencing through computers allows saving of time & ~~travel~~ travelling costs by being able to ~~over~~ connect people in various locations.

## → Arts :-

- Computers are extensively used in digital photography, arts & culture.



- The fluid movement of dance can be shown live via animation.
- Photos can be digitized using computers.
- Science & Engineering :-
  - Computers with high performance are used to stimulate dynamic process in Science & Engineering.
  - Supercomputers have numerous applications in area of R & D.
  - Topographic images can be created through computer.
  - Scientists use computers to plot and analyse data to have a better understanding of earthquakes.

## Types of Computers

Computers can be broadly classify ~~into~~ by their speed, size, computing power, etc.

### (i) Micro - Computers :-

- It is small, low cost which usually consist of micro processor, storage unit, input channel and output channel. All of which is on a PC board.
- Micro - Computers is generally smallest of computer family
- They are designed for individual user only
- It includes desktop, laptops, tablets, smartphones etc.

#### ① Desktop Computer : (PC)

- Desktop computer is the most common micro computer
- It is designed for stand alone use by an individual.
- This computer consist of CPU, monitor, mouse & other peripheral devices.



- Desktop PC are not very expensive to purchase.

eg: HP, lenovo, Dell, etc

### ② Laptop / Notebook :

- Laptop is a portable computer i.e., user can carry it around.
- Since laptop looks like a notebook they are also known as notebooks.
- Laptop are small computers having all features of desktop.
- One advantage of laptop is that user can use it anywhere & at anytime specially when travelling.
- Laptop computers do not need <sup>continuous</sup> external power supply because rechargeable battery is self contained by them.
- Laptop computers are expensive as compared to desktop. eg: lenovo, HP, Asus, Acer, Macbook, etc are various companies who manufacture laptop.

### ③ Hand-Held Computers / Tablets :

- They are also known as PDA, <sup>Personal</sup> ~~Personal~~ Digital Assistant.
- PDA is a computer that ~~is~~ is portable & slightly bigger than calculator, which can be easily stored or kept in pocket & used while

The user is ~~hold~~ ~~holding~~ holding it.

- PDA is an abbreviation for public display of ~~aff~~ affection.
- It can also stand for Personal Digital Assistant.
- PDA uses pen or electronic stylus instead of keyboard for input.
- PDA have very small monitor screen compared to laptop & desktop.
- Since this tablet can easily fit onto the palm, they are also known as palmtop.
- Hand-held computers have no hard disk, they use small card generally known as SD card to store data.
- PDA can be connected to printer to generate output or to store data.
- Because of their limited memory, they are less powerful as compared to laptop & desktop.

### ④ Smartphones :

- A smartphone is a handheld electronic device that provides a connection to a



## cellular network.

- Smartphones allow people to make phone call, send text messages & access the internet.
- ~~Smartphones~~ Basically your smartphone is a mini radio that is constantly on the receiving end of other signals.
- The majority of these devices (smartphones) run on any of popular mobile operating system like Android, ~~IOS~~ iOS, Black berry OS, Symbian, & Windows operating system.
- Smartphones are also equipped with innovative sensors like accelerometers, or even gyroscopes.
- Accelerometers are responsible for displaying screens in portrait & landscape mode, while gyroscopes makes it possible for games to support motion - dash based navigation.
- The earliest touch screen smartphone used resistive touch screen display which required the use of ~~star~~ slender pointing objects known as Styli (Stylus) in singular form.
- Most of the later models however like the iPhone & most android phones employ capacitive display which feature multitouch finger gesture.
- Following are some of the key features of

to Smartphones -



- Internet Connectivity
- A mobile browser
- Touch Screen
- WIFI
- The ability to sync more than one e-mail address to a device.
- A hardware or software based QWERTY keyboard.
- Support for third party application
- A digital camera with video capability
- GPS
- Unified messaging
- The ability to download application & run them independently.
- Bluetooth, Speaker, etc.
- ~~Smartphone~~

- Smartphones commonly ~~use~~ use LCD screens in their display. However OLED displays are becoming more common & preferred by most smartphones manufacturers. (LCD = Liquid Crystal Display) (OLED = Organic Light Emitting ~~Diodes~~ Diodes)

- ~~LED~~ OLED uses single glass or plastic panel compared to LCD which uses 2.

- In addition OLED displays do not need backlight like LCD. So because of this smartphones with an OLED display can be thinner & have much deeper blacks as



each pixel in an OLED display is individually

## (ii) Mini - Computers :-

- Mini computer is small digital computer which normally is able to process & store less data than mainframes but more ~~than~~ data than micro computers.
- It is very speedy in comparison with micro computers but slow than mainframes.
- Mini computer is designed to fulfill the computing needs ~~for~~ for several people simultaneously (parallelly).
- It is capable of supporting 4 to 200 users simultaneously.
- Eg : PDP - 1 is an example of mini computer.

## (iii) Mainframes :-

- Mainframe is a ultra high performance computer made for high volume, processor and intensive computing.
- It consist of high computing processor, capable of supporting, large volume of data processing & extensive data storage & retrieval.
- It is able to process & store more data than mini computer & micro computer.

→ Mainframes are second largest in capability & size of computer family.

→ Mainframes can execute many programs at a same time & at a high speed where the super computers are designed for single processors.

→ They are used in environment where a large no. of users need to share a common computing facility such as research group, bank, education institute, etc.

→ Applications which use this kind of computers includes railway & airline reservation, NASA project, etc.

→ Eg: IBM 3090, IBM 4300

→ It works 24 x 7.

#### (iv) Super - Computers :-

→ Computer system characterized by very high processing speed is called Super - Computers.

→ They are generally used for scientific applications.

→ It is specially designed to maximize no. of FLOPS (Floating Point Operation Per Second).



- Date: \_\_\_\_\_ Page: \_\_\_\_\_
- Any computer below 1 Giga Bytes / Per second is not considered as super computer.
  - It basically consist no. of CPUs that operates in parallel to make it faster.
  - They are fastest, costliest & most powerful computers available today.
  - Super computers are used for weather information, nuclear energy research, defence, space, etc.
  - eg:- PARAM 10,000, CRAY3, etc are example of super computer.

## Block diagram & Functional Unit

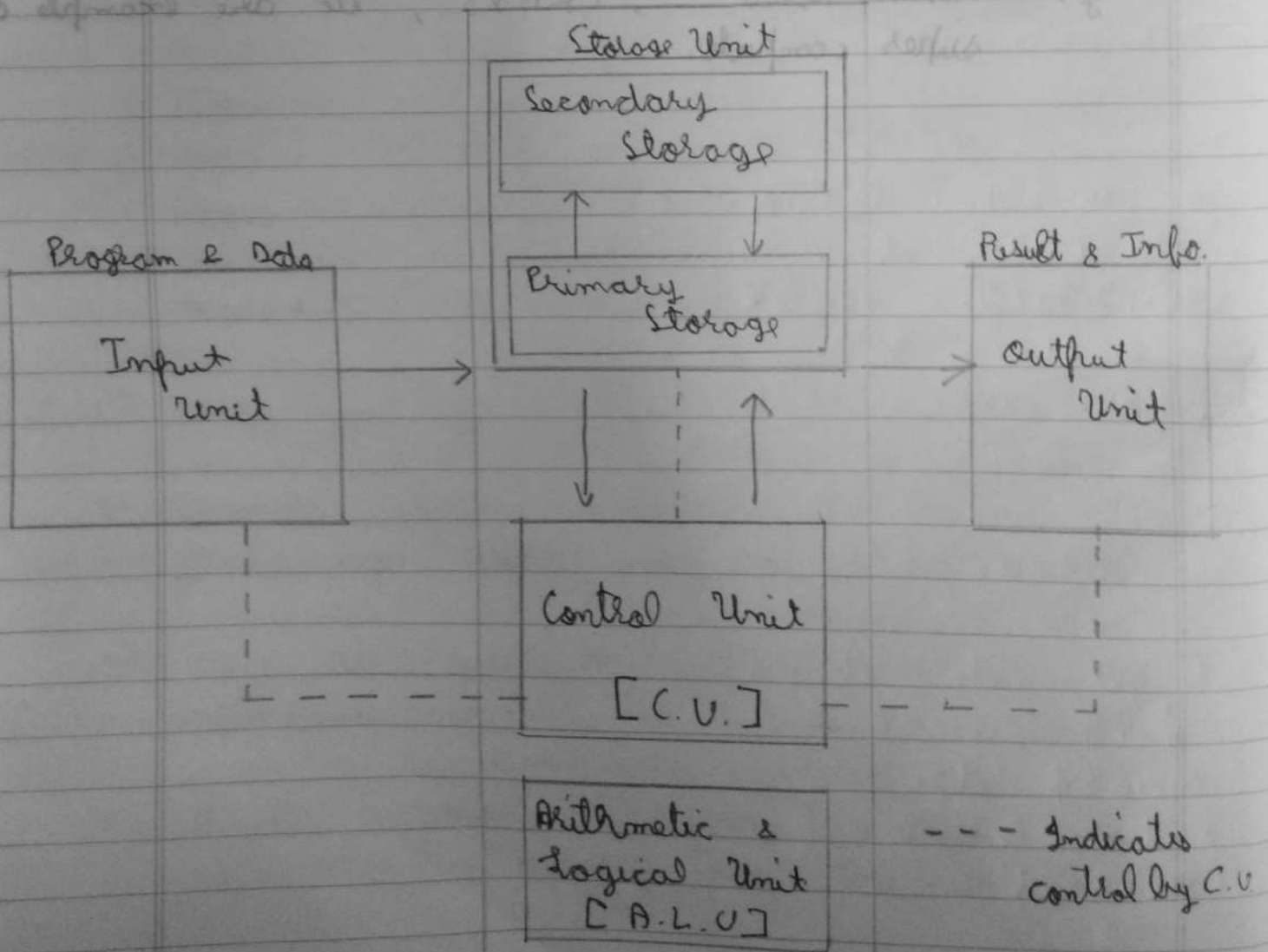
Ques. Explain in detail block diagram of computer.

Write a note on Functional units of computer.

Note on Basic computer organization.

Ans. Input Unit

• Data & instructions





## Input Unit

- Data & instruction must be entered into computer system before any computation performed.
- Data entered in computer using input unit like Keyboard, scanner, mouse or any of the input device.
- Computer accepts data in binary code & hence all input devices transform this data into binary code.
- Input interface performs this task in the foll. ways :-
  - ① It accepts instructions from user.
  - ② It converts this instruction into computer acceptable form (Binary form).
  - ③ It supplies the converted instruction to computer system for further processing (control unit).

## Output Unit

- Output Unit performs the reverse operation of an input unit.
- Supplies info. to outside world.
- It links a computer to an external environment.
- Computer works with binary data & therefore

results are also in binary form.

Therefore before supplying the result to outside world the system must convert them to human acceptable form.

Output interface performs the foll. task :-

- ① Accepts the result produced by computer which is in binary form.
- ② Converts this result into human readable form.
- ③ Supplies the result to outside world (monitor or screen).

## CPU

Storage unit (SU), control unit (CU) & arithmetic & logical unit (ALU) of a computer together known as CPU.

CPU is the brain of a computer system.

## A) Storage Unit

This storage unit holds all the data & instructions to be processed, intermediate results & final results of processing until it is transferred at proper place or released to an output (o/p) unit.



- Storage unit consist of 2 types :
- ① Primary storage / main memory / temporary storage / volatile memory.
  - ② Secondary storage / secondary memory / permanent memory / non-volatile memory.

### 1. Primary Storage

- Primary storage of computer is also known as main memory which holds data & instruction, intermediate results & final results on which computer is currently working.
- CPU can access data directly at very high speed, if it is main memory.
- But main memory can hold info. only when computer system is on, as soon as computer system is switched off the info. in main memory is erased.
- Primary storage has limited storage capacity because it is very expensive & volatile in nature. Volatile means it loses all the info. when power is off.
- It is faster than secondary storage  
eg:- RAM.

### 2. Secondary Storage / Secondary memory / Permanent Storage / Non-volatile memory

- Secondary storage of computer is also known as auxiliary storage.
- It is non-volatile.
- Non-volatile means data remains in computer even if computer is switched off.
- It is cheaper than primary storage.
- It is used to store the large amount of data.
- It is slower than primary storage.

### B) Control Unit (C.U.)

- It does not perform actual processing on data, C.U. act as central nervous system for components of computer system.
- It manages & co-ordinates the entire computer system.
- It obtain instruction from program stored in main memory & uses signals for other units of the system to execute them.



### C) Arithmetic & Logical Unit (A.L.U.)

→ It is a place where actual execution & calculation takes place.

→ All comparisons are made by ALU.

→ ALU can perform basic operation like addition, subtraction, multiplication, division etc & logical operation such as less than, greater than, etc.

### D) Registers

→ Registers are small high speed memory used to store temporary result.

→ Each register has different size & function can be read & write to CPU at very high speed.